EXRADIN ION CHAMBERS

Thimble
Ionization Chambers

STANDARD IMAGING®

User Manual

EXRADIN ION CHAMBERS

Thimble
Ionization Chambers

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General Precautions

Warnings and Cautions alert users to dangerous conditions that can occur if instructions in the manual are not obeyed. Warnings are conditions that can cause injury to the operator, while Cautions can cause damage to the equipment.

WARNING:
Electrical shock hazard when connected to 300 V bias supply.

WARNING:
Exradin Ion Chambers are intended for quality assurance and calibration measurements. They are not intended to be connected to a patient for real-time dosimetry measurements.

CAUTION:
Proper use of this device depends on careful reading of all instructions and labels.

CAUTION:
Do not drop, mishandle, or disassemble unit since it may result in a change of calibration factor, or damage to thin-walled Thimble tip. Refer all servicing to qualified individuals.

CAUTION:
Do not sharply bend triax cable. Damage to the cable may result in high leakage currents.

CAUTION:
Connector end of ionization chamber should not be submerged.

This manual applies to the following thimble chamber models:

Model	REF
A1	92705
T1	92706
A1SL	92722
A2	92718
P2	92720
T2	92721
A12	92700
A12S	92725
A14	92711
T14	92712
A14P	92713
T14P	92714
A14SL	92723
A16	92726
A18	92729
A19	92734

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STANDARD IMAGING

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General Operation

Exradin thimble chambers are attached to a 1.5 m length of low-noise flexible triaxial cable that is terminated by a triaxial or coaxial connector. The collector of the chamber is common with the center wire of the cable and the center contact of the connector. The guard is common with the inner cable braid and the middle connector contact in the case of triaxial connectors and the connector body in the case of coaxial connectors. The shell (outer electrode), usually ground, is common with the outer braid of the cable and the connector body in the case of triaxial connectors and the pigtail extending out the rear of coaxial connectors.

The design of **Exradin** chambers requires that the collector and guard operate at essentially the same potential. The polarizing potential, supplied by an electrometer, is applied between the shell and the guard as shown in **Figure**

1. Either polarity may be applied to the shell and either the shell or guard may be grounded. Safety and other considerations recommend grounding the shell, which then requires an electrometer with a floating input.

All **Exradin** chambers can support 1000 V between shell and guard. However, depending on the particular circumstance and radiation intensity, as little as 90 V may yield essentially 100% charge collection.

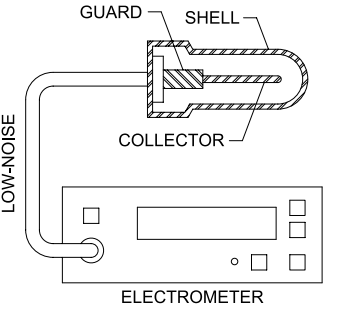


Figure 1: Thimble Chamber and Electrometer

Because **Exradin** ionization chambers do not exhibit voltage soakage phenomena, readings of ionization current may be made immediately after application of the polarizing potential. However, it is good practice to pause a minute or two after changing the potential to allow switching transients induced in the electrometer to completely subside. Such transients are most evident in the rate (current) mode.

Operating Instructions

1. With nothing connected to the input jack of the electrometer, turn the power on and wait at least 15 minutes for warm up.

2. Verify the leakage of the electrometer is within the manufacturer's stated acceptable limits.

3. Connect the ionization chamber to the electrometer and apply 100% voltage bias.

4. Allow the electrometer and ionization chamber system at least 10 minutes to stabilize, making certain that all cabling is lying flat and unkinked.

5. Verify the leakage of the ionization chamber is within the manufacturer's stated acceptable limits. If measured in the presence of background sources, note that this signal will add to the leakage of the chamber.

6. Some electrometers, such as the Standard Imaging MAX-4000 Electrometer, allow the user to zero the device at any time. If desired, perform this system zeroing now.

7. Check the system leakage. Take a reading without exposing the chamber to radiation. This reading should be less than 0.1% of the final signal expected. If it is not, the leakage should be subtracted from the signal.

8. Measure atmospheric temperature and pressure.

9. Insert the ion chamber and take at least 3 measurements. Generally, the measurements should not be moving in only one direction (i.e. three readings that continue to drop and hence may not yet be stabilized). If a current measurement is done, allow sufficient time for value to stabilize.

10. Analyze the data taking into account the average of the readings, system leakage, temperature/pressure corrections, calibration factors and any other appropriate corrections to be made. Keep in mind that the calibration factor consists of the electrometer calibration and the ionization chamber calibration factor.

11. When all measurements are completed, set bias voltage to 0 VDC, turn off the electrometer and disconnect the ionization chamber.

Calibration

As is standard practice for other ionization chambers, it is recommended that Exradin chambers be calibrated every (2) years. This calibration should be performed by an Accredited Dosimetry Calibration Laboratory (ADCL). Standard Imaging offers calibrations from the University of Wisconsin ADCL. You need only one purchase order to cover calibrations, shipping and handling, and service. Standard Imaging hand carries all instruments to and from the University of Wisconsin ADCL.

Parts and Accessories

REF	Description
72122	A1 / A14 Co-60 Cap; 2.0 mm, C552
72125	A1SL / A14SL Co-60 Cap; 2.0 mm, C552
72123	T1 / T14 Co-60 Cap; 4.0 mm, A150
72126	A2 Co-60 Cap; 2.0 mm, C552
72129	T2 Co-60 Cap; 4.0 mm, A150
72128	P2 Co-60 Cap; 4.0 mm, D400
72141	A16 Co-60 Cap; 2.5 mm, C552
72206	A12 Co-60 cap; 2.8 mm, C552
72207	A12S Co-60 cap; 2.8 mm, C552
72161	A12 4 MeV cap; 10.5 mm, Delrin
72159	A12 6 MeV cap; 15.8 mm, Delrin
72162	A12 10 MeV cap; 25.7 mm, Delrin
72163	A12 12 MeV cap; 30.5 mm, Delrin
72164	A12 15 MeV cap; 37.4 mm, Delrin
72160	A12 18 MeV cap; 44.0 mm, Delrin
72138	A14P Co-60 Cap; 2.0 mm, C552
72139	T14P Co-60 Cap; 4.0 mm, A150
72725	A18 Co-60 Cap; 2.0 mm, C552
72762	A19 Co-60 Cap; 2.8 mm, C552
72140	RSVP Phantom™ Adaptation, for models 1, 2, 12, and 14 only
72169	RSVP Phantom™ Adaptation, for models A1SL, A14SL and A16 only

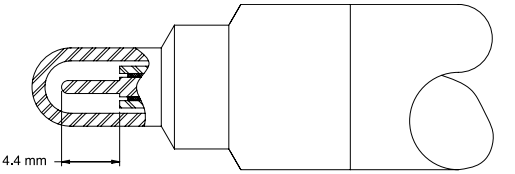
General Chamber Specifications

Nominal Collection Efficiency:	100%
Maximum Polarizing Potential:	No greater than 1000 V
Nominal Inherent Leakage Currents:	Less than 3 x 10^{-15} A
Low-Noise Triaxial Cable:	50 ohms, 29 pF/ft, 1.5 m long
Signal Connector:	Triaxial BNC Plug (2-Lug, male pin); others available upon request
High Voltage Connector:	Integral with triaxial connector (shell of chamber is common with connector body)
Humidity:	30-70%, non-condensing
Temperature:	15 - 35°C
Pressure:	650 - 770 mm Hg
Product Standards:	IEC 60601-1[1], IEC 60731[1] CE 0413

[1] Designed to Meet

Model 1 Miniature Shonka Chamber

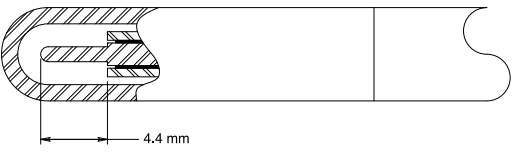
A1 (REF 92705)
T1 (REF 92706)



Collecting Volume:	0.056 cm^3
Nominal Calibration Factor:	60 R/nC
Centroid of Collecting Volume:	4.0 mm from tip of chamber
Collector Diameter:	1.0 mm
Outside Diameter of Shell Collecting Volume:	6.0 mm
Wall Thickness:	1.0 mm
Shell, Collector, and Guard Material:	**A1** – Shonka Air-Equiv. plastic C552 **T1** – Shonka Tissue-Equiv. plastic A150

Model A1SL Slimline Miniature Shonka Chamber

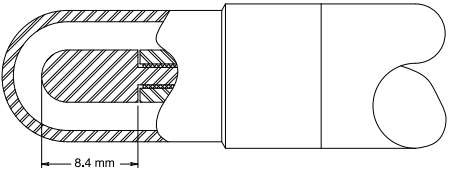
A1SL (REF 92722)



Collecting Volume:	0.056 cm^3
Nominal Calibration Factor:	60 R/nC
Centroid of Collecting Volume:	4.1 mm from tip of chamber
Collector Diameter:	1.0 mm
Outside Diameter of Shell Collecting Volume:	6.25 mm
Wall Thickness:	1.1 mm
Shell, Collector, and Guard Material:	**A1SL** – Shonka Air-Equiv. plastic C552

Model 2 Spokas Chamber

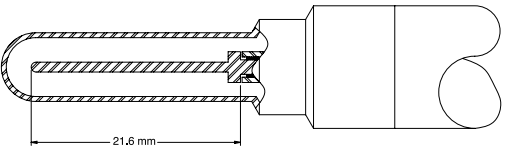
A2 (REF 92718)
P2 (REF 92720)
T2 (REF 92721)



Collecting Volume:	0.5 cm^3
Nominal Calibration Factor:	6 R/nC
Centroid of Collecting Volume:	7.0 mm from tip of chamber
Collector Diameter:	4.6 mm
Outside Diameter of Shell Collecting Volume:	11.5 mm
Wall Thickness:	1.0 mm
Shell, Collector, and Guard Material:	**A2** – Shonka Air-Equiv. plastic C552 **P2** – Polystyrene Equiv. plastic D400 **T2** – Shonka Tissue-Equiv. plastic A150

Model A12 Farmer-Type Chamber

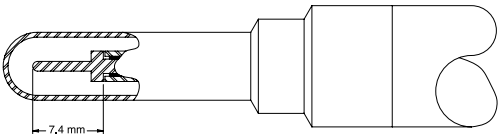
A12 (REF 92700)



Collecting Volume:	0.65 cm^3
Nominal Calibration Factor:	5 R/nC
Centroid of Collecting Volume:	12.9 mm from tip of chamber
Collector Diameter:	1.0 mm
Outside Diameter of Shell Collecting Volume:	7.1 mm
Wall Thickness:	0.5 mm
Shell, Collector, and Guard Material:	**A12** – Shonka Air-Equiv. plastic C552
Included ^{60}Co Buildup Cap:	Wall thickness of 2.8 mm; constructed of C552

Model A12S 0.25 cc Farmer-Type Chamber

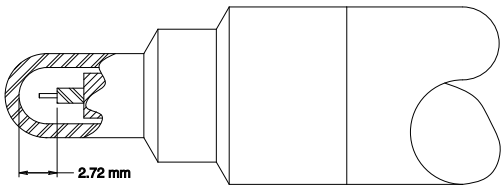
A12S (REF 92725)



Collecting Volume:	0.25 cm^3
Nominal Calibration Factor:	14 R/nC
Centroid of Collecting Volume:	5.8 mm from tip of chamber
Collector Diameter:	1.0 mm
Outside Diameter of Shell Collecting Volume:	7.1 mm
Wall Thickness:	0.5 mm
Shell, Collector, and Guard Material:	**A12S** – Shonka Air-Equiv. plastic C552
Included ^{60}Co Buildup Cap:	Wall thickness of 2.8 mm; constructed of C552

Model 14 Microchamber

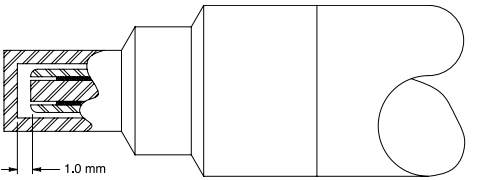
A14 (REF 92711)
T14 (REF 92712)



Collecting Volume:	0.009 cm^3
Nominal Calibration Factor:	365 R/nC
Centroid of Collecting Volume:	Approximately 2.0 mm from tip of chamber
Collector Diameter:	0.33 mm
Outside Diameter of Shell Collecting Volume:	6.0 mm
Wall Thickness:	1.0 mm
Shell, Collector, and Guard Material:	**A14** – Shonka Air-Equiv. plastic C552, Wire, Conductive Plastic **T14** – Shonka Tissue-Equiv. plastic A150

Model 14P Parallel Plate Microchamber

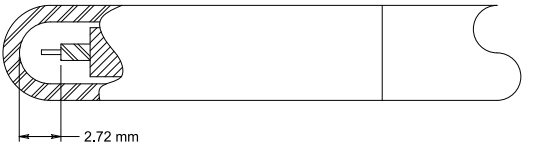
A14P (REF 92713)
T14P (REF 92714)



Collecting Volume:	0.002 cm^3
Nominal Calibration Factor:	1430 R/nC
Centroid of Collecting Volume:	1.5 mm from tip of chamber
Collector Diameter:	1.5 mm
Window Thickness:	1.0 mm
Window Collector Gap:	1.0 mm
Outside Diameter of Shell Collecting Volume:	6.0 mm
Shell, Collector, and Guard Material:	**A14P** – Shonka Air-Equiv. plastic C552 **T14P** – Shonka Tissue-Equiv. plastic A150

Model A14SL Slimline Microchamber

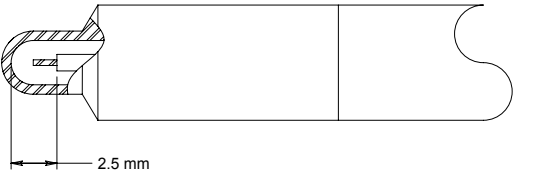
A14SL (REF 92723)



Collecting Volume:	0.009 cm^3
Nominal Calibration Factor:	365 R/nC
Centroid of Collecting Volume:	Approximately 2.1 mm from tip of chamber
Collector Diameter:	0.33 mm
Outside Diameter of Shell Collecting Volume:	6.25 mm
Wall Thickness:	1.1 mm
Shell, Collector, and Guard Material:	**A14SL** – Shonka Air-Equiv. plastic C552

Model A16 Slimline Microchamber

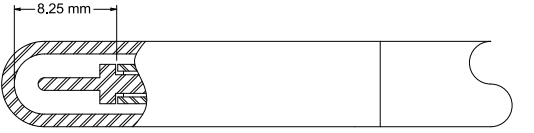
A16 (REF 92726)



Collecting Volume:	0.007 cm^3
Nominal Calibration Factor:	450 R/nC
Centroid of Collecting Volume:	Approximately 1.7 mm from tip of chamber
Collector Diameter:	0.33 mm
Outside Diameter of Shell Collecting Volume:	3.4 mm
Wall Thickness:	0.5 mm
Shell, Collector, and Guard Material:	**A16** – Shonka Air-Equiv. plastic C552, Wire, Conductive Plastic
Included ^{60}Co Buildup Cap:	Wall thickness of 2.5 mm; constructed of C552

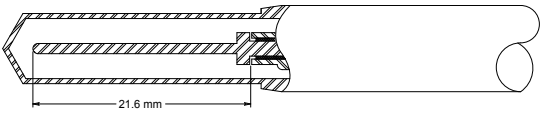
Model A18 0.125 cc Slimline Chamber

A18 (REF 92729)



Collecting Volume:	0.125 cm^3
Nominal Calibration Factor:	25 R/nC
Centroid of Collecting Volume:	4.9 mm from tip of chamber
Collector Diameter:	1.0 mm
Outside Diameter Sensitive Region:	6.9 mm
Wall Thickness:	1.0 mm
Shell, Collector, and Guard Material:	**A18** – Shonka Air-Equiv. plastic C552
Included ^{60}Co Buildup Cap:	Wall thickness of 2.0 mm; constructed of C552

A19 (REF 92734)



Collecting Volume:	0.62 cm^3
Nominal Calibration Factor:	5 R/nC
Centroid of Collecting Volume:	12.8 mm from tip of chamber
Collector Diameter:	1.0 mm
Outside Diameter Sensitive Region:	7.0 mm
Wall Thickness:	0.5 mm
Shell, Collector, and Guard Material:	**A19** – Shonka Air-Equiv. plastic C552
Included ^{60}Co Buildup Cap:	Wall thickness of 2.8 mm; constructed of C552

Service Notes

Calibration Cap
Calibration caps constructed of the same material as the major elements of the chamber are available to provide more than adequate build-up for Cobalt-60 radiation. To seat cap on chamber, push cap onto chamber while slightly rotating clockwise. When the cap is fully seated, it will bottom on the shell tip and provide a small gap between the bottom of the cap and shell step. To remove cap for measurements either in lower energy beams or in a liquid phantom, merely pull on cap while again rotating cap clockwise.

Stem (1, 2, 12, 12S, 14 and 14P only)
The two-piece stem configuration is a 1.3 cm OD black phenolic, with 5.1 and 12.7 cm segments. They are threaded together and can be separated if desired. Different stem configurations are available. In every case, the stem is threaded onto the base of the chamber proper. The stem may be separated from the chamber to provide greater mobility of the chamber when operating in a liquid phantom. The cable connector prevents complete removal of the stem. In unscrewing the stem from the base of the chamber, the chamber must be gripped in the region between the shell and stem. Under no circumstances should the chamber be held by the shell when removing the stem as such may result in unscrewing of the shell.

Stem (A1SL, A14SL, A16, A18 and A19 only)
The one-piece black aluminum stem is an integral part of the ionization chamber assembly and is not to be removed under any circumstances.

A1SL, A14SL, A16	**0.64 cm OD, 5.5 cm long**
A18	**0.69 cm OD, 5.5 cm long**
A19	**1.3 cm OD, 4.6 cm long**

Vent Tube
All **Exradin** ionization chambers now utilize a rugged, flexible tube to allow the chamber to vent. This tube is sealed to the chamber body and is open to the ambient near the connector. The triaxial cable of the chamber passes through this vent tube.

DO NOT attempt to alter or remove this vent tube from the chamber under any circumstance. Doing so will void the warranty, allow the chamber to leak if placed in water, and/or possibly loosen the cable from the chamber thereby destroying any calibration factor. Any modifications should be only done by Standard Imaging, Inc.

Underwater Operation
All **Exradin** thimble chambers are inherently waterproof; they require no sleeves, caps or other devices to achieve this. For those models with removable stems, removing any or all segments of the stem from the chamber body will not effect the waterproofness of the chamber.

⚠ **Service and Maintenance**
There are no user-serviceable parts within these ionization chambers. Under no circumstance should the user attempt to repair or disassemble the chamber and/or connector, as the warranty will become void and the calibration factor will change. Under normal use, the chambers should provide years of trouble-free service.

If assistance is desired in the proper disposal of this product (including accessories and components), after its useful life, please return to Standard Imaging.

Service Policy

If service, including recalibration, is required, please contact Standard Imaging's Customer Service department by phone or email prior to shipping the product. Standard Imaging's Customer Service and Technical Service staff will attempt to address the product issue via phone or email. If unable to address the issue, a return material authorization (RMA) number will be issued. With the RMA number, the product can be returned to Standard Imaging. It is the responsibility of the customer to properly package, insure and ship the product, with the RMA number clearly identified on the outside of the package. The customer must immediately file a claim with their carrier for any shipping damage or lost shipments. Return shipping and insurance is to be pre-paid or billed to the customer, and the customer may request a specific shipper. Items found to be out of warranty are subject to a minimum service fee of 1 hour labor (excluding recalibrations) for diagnostic efforts and require a purchase order (PO) before service is performed. With concurrence from customer, the product may be replaced if it is unserviceable or if the required service is cost prohibitive. Products incurring service charges may be held for payment. Standard Imaging does not provide loaner products. See the Standard Imaging Warranty and Customer Responsibility for additional information.

Serialization Information

Standard Imaging products that are serialized contain coded logic in the serial number which indicates the product, day and year of manufacture, and a sequential unit number for identification:

A YY DDD X

A Unique product ID
YY Last two digits of the year (e.g. 1999 = 99, 2000 = 00)
DDD Day of the year (1≤ DDD ≤ 365)
X Unique unit ID Number (1 ≤ X ≤ 9)

Customer Responsibility

This product and its components will perform properly and reliably only when operated and maintained in accordance with the instructions contained in this manual and accompanying labels. A defective device should not be used. Parts which may be broken or missing or are clearly worn, distorted or contaminated should be replaced immediately with genuine replacement parts manufactured by or made available from Standard Imaging Inc.

⚠ **CAUTION: Federal law in the U.S.A. and Canadian law restrict the sale, distribution, or use of this product to, by, or on the order of a licensed medical practitioner. The use of this product should be restricted to the supervision of a qualified medical physicist. Measurement of high activity radioactive sources is potentially hazardous and should be performed by qualified personnel.**

Should repair or replacement of this product become necessary after the warranty period, the customer should seek advice from Standard Imaging Inc. prior to such repair or replacement. If this product is in need of repair, it should not be used until all repairs have been made and the product is functioning properly and ready for use. After repair, the product may need to be calibrated. The owner of this product has sole responsibility for any malfunction resulting from abuse, improper use or maintenance, or repair by anyone other than Standard Imaging Inc.

The information in this manual is subject to change without notice. No part of this manual may be copied or reproduced in any form or by any means without prior written consent of Standard Imaging Inc.

Warranty

Standard Imaging, Inc. sells this product under the warranty herein set forth. The warranty is extended only to the buyer purchasing the product directly from Standard Imaging, Inc. or as a new product from an authorized dealer or distributor of Standard Imaging, Inc.

For a period provided in the table below from the date of original delivery to the purchaser or a distributor, this Standard Imaging, Inc. product, provided in the table is warranted against functional defects in design, materials and workmanship, provided it is properly operated under conditions of normal use, and that repairs and replacements are made in accordance herewith. The foregoing warranty shall not apply to normal wear and tear, or if the product has been altered, disassembled or repaired other than by Standard Imaging, Inc. or if the product has been subject to abuse, misuse, negligence or accident.

Product	Warranty Period
Standard Imaging Ionization Chambers	2 years
Standard Imaging Well Chambers	2 years
Standard Imaging Electrometers	2 years
Standard Imaging BeamChecker Products	2 years
Standard Imaging Software Products	1 year
All Other Standard Imaging Products	1 year
Standard Imaging Custom Products	1 year
Standard Imaging Remanufactured Products	180 days
Standard Imaging Custom Select Products	90 days
Consumables	90 days
Serviced Product	90 days
Resale Products	As defined by the Original Equipment Manufacturer
ADCL Product Calibration (Standard Imaging uses the UW-ADCL for recalibrations required under warranty)	0 - 90 days = 100% of ADCL Calibration Costs 91 - 182 days = 75% of ADCL Calibration Costs 183 – 365 days = 50% of ADCL Calibration Costs 366 – 639 days = 25% of ADCL Calibration Costs (days from date of shipment to customer)

Standard Imaging's sole and exclusive obligation and the purchaser's sole and exclusive remedy under the above warranties are, at Standard Imaging's option, limited to repairing, replacing free of charge or revising labeling and manual content on, a product: (1) which contains a defect covered by the above warranties; (2) which are reported to Standard Imaging, Inc. not later than seven (7) days after the expiration date of the warranty period in the table; (3) which are returned to Standard Imaging, Inc. promptly after discovery of the defect; and (4) which are found to be defective upon examination by Standard Imaging Inc. Transportation related charges, (including, but not limited to shipping, customs, tariffs, taxes, and brokerage fees) to Standard Imaging are the buyer's responsibility. This warranty extends to every part of the product except consumables (fuses, batteries, or glass breakage). Standard Imaging, Inc. shall not be otherwise liable for any damages, including but not limited to, incidental damages, consequential damages, or special damages. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days.

This warranty is in lieu of all other warranties, express or implied, whether statutory or otherwise, including any implied warranty of fitness for a particular purpose. In no event shall Standard Imaging, Inc. be liable for any incidental or consequential damages resulting from the use, misuse or abuse of the product or caused by any defect, failure or malfunction of the product, whether a claim of such damages is based upon the warranty, contract, negligence, or otherwise.

This warranty represents the current standard warranty of Standard Imaging, Inc. Please refer to the labeling or instruction manual of your Standard Imaging, Inc. product or the Standard Imaging, Inc. web page for any warranty conditions unique to the product.